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NISHIO KIMITAKA**(54) COMPOSITION FOR FILM-TYPE ADHESIVE****(57)Abstract:**

PROBLEM TO BE SOLVED: To provide a film-type insulating adhesive which shows a high thickness precision and position precision, inhibits the generation of voids, suppresses the stress generated when bonding dissimilar materials, e.g. when bonding semiconductor chips to lead frames or circuit boards, and exerts an excellent adhesion workability.

SOLUTION: A film-type adhesive is prepared by forming into a film a composition which essentially comprises (A) silica, (B) a phenoxy resin, (C) a glycidyl ether epoxy resin and (D) an epoxy resin hardener, wherein the amount of silica (A) contained is from 50 to 80 wt.% and the weight ratio of the phenoxy resin (B) to the glycidyl ether epoxy resin (C) is from 0.02 to 1. Here, the linear expansion coefficient after curing is 30 ppm or smaller.

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CLAIMS

[Claim(s)]

[Claim 1] (A) The constituent for film glue which uses a silica, (B) phenoxy resin, (C) glycidyl ether mold epoxy resin, and (D) epoxy resin curing agent as an indispensable component, and is characterized by for the silica content in a constituent being 50 - 80wt%, and the range of the weight ratio of (B) phenoxy resin / (C) glycidyl ether mold epoxy resin being 0.02-1.

[Claim 2] The constituent for film glue according to claim 1 whose rate of a particle spherical silica that a silica is the mixture of a spherical silica with a mean particle diameter of 5-40 micrometers and a particle spherical silica with a mean particle diameter of 0.1-5 micrometers, and occupies in [all] a silica is less than [50wt%].

[Claim 3] The constituent for film glue according to claim 1 or 2 whose softening temperature of the resinous principle in a constituent is 100 degrees C or less.

[Claim 4] Film glue which comes to make the constituent for film glue according to claim 1 to 3 into the shape of a film with a thickness of 10-150 micrometers.

[Claim 5] Film glue whose coefficient of linear expansion in ordinary temperature it is the hardened material of film glue according to claim 4, and is below 30 (x10⁻⁶).

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the insulating film glue constituent suitable for joining a semiconductor chip, a leadframe, or the circuit board in detail about a film glue constituent.

[0002]

[Description of the Prior Art] As for the die bonding ingredient on which a semiconductor chip, a leadframe, or the circuit board is pasted up in the ingredient which constitutes the semiconductor package represented by DIP, SOP, QFP, BGA, and CSP, an Au-Si eutectic alloy, solder, a silver paste, etc. have been used conventionally. In current and a general-purpose and large-sized package, adhesion by the silver paste from synthetic decision of productivity, heat dissipation nature, large chip applicability, a price, etc. is in use. The silver paste was applied to a leadframe or the circuit board by the dispensing method, and while it showed the productivity which was excellent from the ability also of temporary sticking by pressure of a semiconductor chip to be made easy, since it was liquefied, it had the problem that control of adhesion thickness precision, spreading location precision, and void loess was difficult.

[0003] In recent years, an area array type chip-size package appears, and it is contributing to small and light-ization of a pocket device greatly. however, such a package -- a semiconductor chip and a package -- magnitude -- as long as -- since it approaches that there is nothing, while, as for the fillet area when pasting up a semiconductor chip, a leadframe, and the circuit board, a minimum area is called for, it is also required for coincidence that a chip adhesion side should be completely covered with a glue line. Furthermore, since the void inside the formed glue line affects humidity-tolerant reliability and a package crack greatly, it is desirable that he is a void free-lancer. The demand in the adhesives of a higher location precision from the above circumstances having increased, and maintaining the productivity of the conventional paste-like adhesives, thickness precision and location precision were high and the film glue which a void cannot produce easily was called for. Moreover, if an area array type semiconductor package performs evaluation which accelerates the damage by stress like a heat cycle test after being mounted in a mother board, the adhesives which control the stress generated by the difference in the coefficient of linear expansion of the dissimilar material joined from having generated the problem on which a part for a joint with a package component or a mother board ingredient is destroyed by the stress generated in the difference in coefficient of linear expansion are also called for.

[0004] On the other hand, what used phenoxy resin, the polyfunctional glycidyl ether mold epoxy resin, and the latency curing agent as the indispensable component is indicated by JP,5-320610,A as an adhesives constituent used for film glue. However, the property which controls stress by relation with the adherend described above since coefficient of linear

expansion was large is not only inferior, but the film glue indicated here has a problem in temporary sticking-by-pressure nature, when it uses for an area type semiconductor package. [0005]

[Problem(s) to be Solved by the Invention] The purpose of this invention is to offer the insulating film glue which controlled the stress generated at the time of junction between dissimilar material which joins a semiconductor chip, a leadframe, or the circuit board in addition to having a film glue [with high thickness precision and location precision] property with little [as much as possible] generating of a void, and was excellent in the workability at the time of adhesion (temporary sticking-by-pressure nature).

[0006]

[Means for Solving the Problem] this invention person etc. came to complete a header and this invention for it being effective in the constituent which has the specific property in which the silica was added to the conventional constituent solving the above-mentioned problem, as a result of inquiring wholeheartedly.

[0007] That is, this invention is a constituent for film glue which uses the (A) silica, (B) phenoxy resin, (C) glycidyl ether mold epoxy resin, and (D) epoxy resin curing agent as an indispensable component, and is characterized by for the silica content in a constituent being 50 - 80wt%, and the range of the weight ratio of (B) phenoxy resin / (C) glycidyl ether mold epoxy resin being 0.02-1. Moreover, this invention is said constituent for film glue whose rate of a particle spherical silica that a silica is the mixture of a spherical silica with a mean particle diameter of 5-40 micrometers and a particle spherical silica with a mean particle diameter of 0.1-5 micrometers, and occupies in [all] a silica is less than [50wt%]. Furthermore, this invention is said constituent for film glue whose softening temperature of the resinous principle in a constituent is 100 degrees C or less.

[0008] Moreover, this inventions are the film glue which comes to make the constituent for film glue into the shape of a film with a thickness of 10-150 micrometers, and film glue whose coefficient of linear expansion in the ordinary temperature which hardens this and is acquired is 30 ppm or less.

[0009]

[Embodiment of the Invention] Although especially the (A) silica used for this invention is not limited, the letter of crushing and spherical fused silica powder are mentioned. It is desirable that it is the mixture of the spherical silica whose mean particle diameter is 5-40 micrometers also in it, and a particle [whose mean particle diameter is 0.1-5 micrometers] spherical silica. In this case, as for the rate of the particle spherical silica occupied in a full-spherical silica, it is desirable that it is less than [50wt%], and it is more desirable that it is the range of 5 - 50wt%. When there are more rates of a particle spherical silica than 50wt(s)%, the melt viscosity of a constituent increases, there is an inclination to reduce a temporary sticking-by-pressure property, and when there are few rates of a particle spherical silica than 5wt(s)%, there is an inclination for the surface state of the sheet when considering as film glue to worsen, or for the sheet itself to become a little weak. the film front face which became broad particle size distribution and was stabilized when a particle spherical silica ratio was 5 - 50wt% — description and a film fluidity are shown.

[0010] Although more possible ones of the amount of the total used of the silica in a constituent are good for coefficient-of-linear-expansion reduction, it is required to be the range of 50 in whole constituent - 80wt%. If a silica content exceeds 80wt(s)%, it will become weak film glue by viscosity rise of the constituent by lack of the resinous principle which works as a binder, and the temporary sticking-by-pressure engine performance will be reduced remarkably. Since the work to which a silica content controls the stress between a semiconductor chip, a leadframe, and the circuit board less than [50wt%] since coefficient of linear expansion cannot fully decrease is small, it is not desirable. For example, the case which

cannot bear the stress generated in the cases, such as a heat cycle test (-65-150 degrees C) after being assembled by the package, arises.

[0011] Well-known phenoxy resin can be used for (B) phenoxy resin used for this invention. Usual and molecular weight which are obtained from a bisphenol and epichlorohydrin whose phenoxy resin is are 10,000 or more thermoplastics. [like bisphenol A] Since an epoxy resin and structure are similar, as for this phenoxy resin, the description that compatibility is good and an adhesive property is also good is shown. Desirable phenoxy resin is mentioned as what has commercial desirable phenoxy resin, such as bisphenol A / F hybrid model phenoxy resin, and bromination phenoxy resin, although the main frame is the thing of the bisphenol A mold.

[0012] (C) glycidyl ether mold epoxy resin used for this invention can use independent or multiple mixture. As a glycidyl ether mold epoxy resin which can be used A phenol novolak glycidyl ether mold, an orthochromatic cresol novolak glycidyl ether mold, A fluorene bisphenol glycidyl ether mold, a triazine glycidyl ether mold, A naphthol glycidyl ether mold, a naphthalene diol glycidyl ether mold, A triphenyl glycidyl ether mold, a tetra-phenyl-glycidyl-ether mold, A bisphenol A glycidyl ether mold, a bisphenol F glycidyl ether mold, a bisphenol A D glycidyl ether mold, a bisphenol S glycidyl ether mold, a trimethylolmethane glycidyl ether mold, etc. are mentioned as an example. Also in these, what has two or more Grouchy Jill ether groups in intramolecular is desirable. [0013] (C) the mixing ratio of an epoxy resin and (B) phenoxy resin -- although it changes with combination, a rate is desirable from the outstanding temporary sticking-by-pressure nature being shown, when what has most preferably 50-100 degrees C of 100 degrees C or less of softening temperatures of the mixture of a resinous principle in the range of 65-90 degrees C still more preferably makes this the film glue of this invention. Since temporary sticking by pressure on mild conditions becomes difficult while a sheet is hard and becomes weak, when the softening temperature of a resinous principle exceeds 100 degrees C, it is not desirable, and when softening temperature is 50 degrees C or less, while tuck nature is strongly discovered on a sheet front face and handling nature gets worse remarkably, since the fault that a sheet flows at the time of ordinary temperature preservation occurs, it is not desirable. Here, a resinous principle means the (C) epoxy resin, (B) phenoxy resin, and the resin (however, (D) epoxy resin curing agent is removed) added as occasion demands in addition to this, and the softening temperature of a resinous principle says the softening temperature when making these into a uniform constituent. and the weight ratio calculated with (B) phenoxy resin / (C) epoxy resin -- 0.02-1 -- it is the range of 0.1-0.7 preferably.

[0014] Although the resinous principle in the constituent of this invention uses an epoxy resin and phenoxy resin as a principal component, as long as it is range which does not spoil the effectiveness of this invention, it may carry out little content of other resinous principles. As for the rate of the phenoxy resin occupied in the resinous principle in a constituent, it is desirable that it is less than [50wt%]. By making the rate of phenoxy resin into less than [50wt%], it becomes easy to give the support nature as film glue (for it to also be called an adhesion sheet or a sheet). Here, the rate of the phenoxy resin in a resinous principle has a desirable thing in the range of 10 - 50wt%. since a sheet will become weak and the softening temperature of a resinous principle also becomes low, when the rate of phenoxy resin is less than [10wt%] -- sheet independent support nature -- discovered -- hard -- moreover, phenoxy resin -- if 50wt% is exceeded comparatively -- a sheet -- hard -- becoming -- a sheet -- it becomes easy to be divided if independent.

[0015] Although well-known curing agents, such as amines, acid anhydrides, and polyhydric phenols, can be used for (D) epoxy resin curing agent used for this invention, it is the latency curing agent which demonstrates hardenability above the temperature which shows the adhesiveness which needs, desirable temperature predetermined [beyond ordinary

temperature], for example, said resinous principle, and moreover demonstrates fast curability. To a latency curing agent, the thing of a dicyandiamide, imidazole derivatives, hydrazides, a 3 fluoridation boron-amine complex, amine imide, polyamine salts and these denaturation objects, and also a microcapsule type is also usable. these are independent – or two or more sorts can be used, mixing. The constituent for film adhesives with the high preservation stability in which the mothball in a room temperature is also possible can be offered by using a latency curing agent. The range of the amount of the epoxy resin curing agent used is usually 0.5 - 50wt% to an epoxy resin.

[0016] In the insulating film glue constituent obtained above, it is also possible as other additives to contain butadiene system rubber, silicone rubber, etc. as a coupling agent, an anti-oxidant, a flame retarder, a coloring agent, and a stress relaxation agent.

[0017] A coupling agent is desirable from the purpose of the improvement in adhesive strength while it reinforces an interface with a silica and makes high disruptive strength discover. As a coupling agent, the thing containing the amino group and an epoxy group is desirable. [0018] The film glue of this invention is obtained by independent or carrying out coating of the varnish made to dissolve this constituent in mixture to base materials (protection film), such as PP, PE, PET, etc. by which mold release processing was carried out, performing heat treatment below the hardening initiation temperature of resin mixture, and drying [of ether systems, such as ketone systems, such as aromatic hydrocarbon, such as toluene and a xylene, MIBK, and MEK, mono-glyme, and a jig lime]. As for the thickness of the film glue formed from the constituent of this invention, it is good that it is the range of 10-150 micrometers.

[0019] As for the coefficient of linear expansion of the hardened material of the constituent of this invention, or the hardened material of film glue, in ordinary temperature, it is desirable that it is 30 ppm or less. If the value of coefficient of linear expansion is higher than 30 ppm, since the difference of coefficient of linear expansion with a leadframe, the circuit board, etc. will become large, the effectiveness which controls stress with the object pasted [these] up is low, and leads to making some products destroy and is not desirable. In order to double with the coefficient of linear expansion of a leadframe or the circuit board, 10-20 ppm is more desirable.

[0020] Although the film glue of this invention is used for various kinds of applications and is usable at various kinds of operation, it is suitable for the following operation. For example, when pasting up a chip etc. on a substrate, the film glue first cut in a predetermined configuration and magnitude is arranged in the predetermined location of a substrate, is heated at 50 degrees C or more, and temporary sticking by pressure is carried out, applying about two 0.5 - 5 kgf/cm **. Under the present circumstances, the configuration of a film and magnitude are good not to change as much as possible. In ordinary temperature, although film glue is good for there to be almost no adhesiveness and to demonstrate adhesiveness above 50 degrees C, temporary sticking by pressure of it is carried out below with the curing temperature. In order to prevent generating of a void, a pressure is required, but if too high, deformation of a film etc. will arise. After carrying out temporary sticking by pressure of the film glue, the protection film by the side of a front face is removed, a chip is carried on this, hardening of temporary sticking by pressure and film glue is performed, and a substrate and a chip are completely pasted up through hardening film glue. Hardening is performed by applying the heat more than curing temperature. It says that there is little deformation of film glue that temporary sticking-by-pressure nature here is excellent, that there is little generating of a void, that predetermined bond strength arises according to adhesion, etc.

[0021]

[Example] Weighing capacity of example 1YP-50 (phenoxy resin, weight-average-molecular-weight 59,000, and Tg about 100degree-C, Tohto Kasei Co., Ltd. make) 20g, YDCN-702 (polyglycidyl-ether-of-o-cresol-form-aldehyde-novolac, 75 degrees-C [of softening

temperatures], Tohto Kasei Co., Ltd. make) 50g, and the YD-127 (bisphenol A mold epoxy resin, Tohto Kasei Co., Ltd. make) 40g was carried out, by using 80g MIBK as a solvent, among the 500ml separable flask, heating stirring was carried out at 110 degrees C for 2 hours, and the resin varnish was obtained. Weighing capacity of the 190g of this solution was carried out to the 800ml planetary mixer, and what added FB-48 (spherical silica, 16 micrometer [of mean diameters], product made from DENKA) 240g and SO-C2 (particle spherical silica, 0.5 micrometer [of mean diameters], ADOMA tex company make)40g, and was mixed was kneaded with 3 rolls. AH-150(dicyandiamide, Ajinomoto Co., Inc. make) 8g and HX-3722(microcapsule type imidazole system latency curing agent, Asahi tiba company make) 2g were added to this mixture, with the planetary mixer, after stirring mixing, vacuum degassing was carried out and the mixed varnish was obtained. After applying the above-mentioned mixed varnish on the PET film with a thickness of 50 micrometers by which mold release processing was carried out, hot air drying was carried out in 120 degrees C / 5 minutes, and the adhesion sheet of 70-micrometer thickness, i.e., film glue, was obtained for 60 degrees C / 5 minutes.

[0022] The temporary sticking-by-pressure engine performance of this film glue placed film glue with a magnitude of 10x10mm on the 125-micrometer copper plate, and evaluated it by observing the appearance which stuck by pressure the heat block heated at 60 degrees C to the copper plate of film glue after the press for 3 seconds by the pressure of 3kg/cm² by the air cylinder. After the press, what has carried out temporary sticking by pressure of the film glue completely was made into O (good), the adhesive agent (non-filling) was made into O, the thing of outflow (flow) was made into ** and four-step evaluation which makes x what was hardly able to be stuck by pressure was performed.

[0023] a sheet -- description -- an adhesion sheet surface state, the detachability from a mold release processing PET film, the support nature in an independent sheet, flexibility, brittleness, etc. -- observing -- O (good) and O -- almost -- fitness and ** -- it evaluated in four a little bad steps of x (bad).

[0024] Resin mixture softening temperature sheet-ized independently the resin varnish obtained as a middle article of film adhesive creation time by 70-degree-C reduced pressure drying, and measured what removed the solvent with dropping type softening point apparatus (product made from Mettler FP83 METORA).

[0025] What cut the moldings which pressed film glue on 180 degrees C and the hardening conditions of 1 hour in magnitude of 4x4x10mm was used for coefficient of linear expansion as a test piece, and it is an apparatus for thermomechanical analysis (product made from a TMA SSC5200 SEIKO electron), and asked for the coefficient of linear expansion in the range of 10-30 degrees C after measurement by part for -100-300-degree-C and programming-rate/of 7 degrees C.

[0026] The following examples are examples which the presentation of a constituent was changed, and also manufactured film glue like the example 1, and were evaluated similarly.

[0027] As an example 2 glycidyl-ether mold epoxy resin, EPPN-501H (polyfunctional glycidyl ether mold epoxy resin, 55 degrees-C [of softening temperatures], Nippon Kayaku Co., Ltd. make)60g and YD-127 [30g] were used, and also the adhesion sheet was manufactured like the example 1, and it evaluated.

[0028] As an example 3 glycidyl-ether mold epoxy resin, ESN-185 (naphthalene system glycidyl ether mold epoxy resin, 85 degrees-C [of softening temperatures], Nippon Steel Chemical Co., Ltd. make) 50g and YD-127 [40g] were used, and also the adhesion sheet was manufactured like the example 1, and it evaluated.

[0029] As an example 4 glycidyl-ether mold epoxy resin, used only YD-127, and YP-50 [70g / 40g] were further used as phenoxy resin, and also the adhesion sheet was manufactured like the example 1, and it evaluated.

[0030] As example 5 silica, 180g and 100g of SO-C2 were used for FB-48, and also the adhesion sheet was manufactured like the example 1, and it evaluated.

[0031] As example 6 silica, 300g and 50g of SO-C2 were used for FB-48, and also the adhesion sheet was manufactured like the example 1, and it evaluated.

[0032] As example 7 silica, only FB-48 [280g] were used, and also the adhesion sheet was manufactured like the example 1, and it evaluated.

[0033] As example 8 silica, 130g and 150g of SO-C2 were used for FB-48, and also the adhesion sheet was manufactured like the example 1, and it evaluated.

[0034] As an example 9 glycidyl-ether mold epoxy resin, used 65g and YD-127 [40g] for YDCN-702, and YP-50 [5g] were further used as phenoxy resin, and also the adhesion sheet was manufactured like the example 1, and it evaluated.

[0035] Only YDCN-702 [90g] were used as an example 10 glycidyl-ether mold epoxy resin, and also the adhesion sheet was manufactured like the example 1, and it evaluated.

[0036] As example of comparison 1 silica, 90g and 20g of SO-C2 were used for FB-48, and also the adhesion sheet was manufactured like the example 1, and it evaluated.

As example of comparison 2 silica, 600g and 100g of SO-C2 were used for FB-48, and also the adhesion sheet was manufactured like the example 1, and it evaluated.

Used only YD-127 as an example of comparison 3 glycidyl-ether mold epoxy resin, and YP-50 [60g] were used as 50g and phenoxy resin, and also the adhesion sheet was manufactured like the example 1, and it evaluated.

Example of comparison 4 silica was not used at all, and also the adhesion sheet was manufactured like the example 1, and it evaluated. The above presentation and an evaluation result are collectively shown in Table 1.

[0037]

[Table 1]

	例										比較例			
	1	2	3	4	5	6	7	8	9	10	1	2	3	4
YDCN-702	50				50	50	50	50	55	90	50	50		50
EPPN601H														
YD-127	40	30	40	70	40	40	40	40	40		40	40	50	40
YP-50	20	20	20	40	20	20	20	20	5	20	20	20	60	20
HT-150	8	8	8	8	8	8	8	8	8	8	8	8	8	8
SK-3732	2	2	2	2	2	2	2	2	2	2	2	2	2	2
FB-48	240	240	240	240	180	300	280	130	240	240	90	600	240	
SO-C2	40	40	40	40	100	50		150	40	40	20	100	40	
樹脂硬化点(°C)	70	75	80	85	70	70	70	70	85	105	70	70	95	70
仮圧着性	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	△	×	◎	△
シート性状	良好	良好	良好	良好	良好	良好	良好	未充填	良好	未充填	流れ	不可	未充填	流れ
銅板接着	◎	◎	◎	◎	◎	◎	◎	△	△	△	△	×	×	△
銅板接着率(ppm)	19	20	17	20	20	13	20	21	19	19	35	10	19	60

[0038] On the level whose content of a silica is 70wt(s)%, coefficient of linear expansion was set to 17-20 ppm, and about the same coefficient of linear expansion as the circuit board was shown. although the class of glycidyl ether mold epoxy resin was changed in the examples 1-3 – an orthochromatic cresol mold, a polyfunctional mold, and a naphthalene mold – the temporary sticking-by-pressure engine performance with good all, and a sheet – description was shown. It was a coefficient of linear expansion lower than other frames especially about a naphthalene mold. Although silica combination was changed in the examples 5, 6, 7, and 8 to the example 1, when the whole-quantity spherical silica was used, the gloss on the front face of a sheet fell, and it was a little weak. Moreover, in the field in which the amount of the particle spherical silica used exceeds 50%, the sheet was hard, and became a little weak, and being un-filled up also generated the temporary sticking-by-pressure evaluation with a copper plate a little. Although the amount of the silica used was changed in examples 1 and 6 and the

examples 1, 2, and 4 of a comparison, when the amount of the silica used was less than [50wt%], the outflow at the time of temporary sticking by pressure and the smeariness on the front face of a sheet became intense, and the support nature of a sheet did not have them, either. Moreover, when exceeding 80wt%, temporary sticking by pressure could not be carried out, but the sheet was also weak. Although the phenoxy resin ratio occupied in resin mixture was changed in examples 4 and 9 and the example 3 of a comparison to the example 1, when a sheet was soft, support nature fell at the time not more than 10wt% and 50wt% was exceeded, it became a hard and weak sheet and being un-filled up also generated temporary sticking-by-pressure nature. Although the softening temperature of resin mixture was changed in the example 10 and the example 3 of a comparison, being un-filled up occurred a little at the time of the softening temperature exceeding 100 degrees C. In addition, the outflow at the time of temporary sticking by pressure and the smeariness on the front face of a sheet became intense, and the thing of the example 4 of a comparison which has not blended the silica does not have the support nature of a sheet, either, and turned into what also has a big coefficient of linear expansion.

[0039]

[Effect of the Invention] With the constituent for film glue of this invention, the film glue for semiconductor chip junction of low coefficient of linear expansion which can be stuck by pressure temporary can be offered on mild conditions. Since it becomes possible to stop the stress generated at the time of junction of a dissimilar material like combination, such as a semiconductor chip, a leadframe, and the circuit board, to the minimum since it has the coefficient of linear expansion put close to a semiconductor chip, a leadframe, and the circuit board, the constituent for film glue of this invention can prevent destruction of a product. Furthermore, without attaining temporary sticking by pressure on the mild conditions of low temperature, low voltage, and a short time, and reducing a production rate to using as a binder the resin mixture which adjusted softening temperature compared with the dispensing method at the time of paste ingredient use, since it is hard to generate a void, it becomes possible to form a glue line with a smooth high location precision.

[Translation done.]